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A TWELVE YEAR COUNT OF THREE CALIFORNIA BUTTERFLIES

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ABSTRACT. A weekly population count of three northern California butterflies, *Danaus plexippus*, *Nymphalis antiopa* and *Papilio rutulus*, over twelve years was conducted in a lowland California suburban yard. The data support Shapiro's theory that *N. antiopa* goes into hibernation locally about mid-June. They do not support the occasionally heard statement that the numbers of butterflies are declining; no systematic trend is evident, but year-to-year fluctuations are pronounced. A hypothesis that *P. rutulus* thrives on extremes of rainfall is proposed.

Most Lepidopterists cannot afford the time to do long-term butterfly counts. This is a twelve year count of the northern California butterflies, *Danaus plexippus* (Linnaeus, Danidae), *Nymphalis antiopa* (Linnaeus, Nymphalidae), and *Papilio rutulus* (Lucas, Papilionidae), made in a suburban Citrus Heights, Sacramento County, yard. The dominant vegetation was *Quercus wislizenii, Juglans hindsii, Fraxinus velutina, Catalpa speciosa,* and a variety of unknown grasses. Flowers that attract butterflies are *Vinca major, Verbena peruviana, Phlox* spp., and *Rhododendron* spp. There are many other flowers that were rarely if ever visited.

Citrus Heights lies in a Mediterranean climatic regime, with very high year-to-year variability in both seasonal precipitation and its timing (Figgins, 1979). The study period (1970–1982) embraces the most extreme and variable northern California weather in the 20th century, and to the extent that weather influences butterfly population levels, which is at least a debatable point (Shapiro, 1979), the counts reported should reflect the range of variation of which these species are capable.

The field of view was generally 100 m to the north, east, and south with obstructions of shrubs and trees 10 m to the northeast and southeast. Observations to the west were sporadic to 20 m. The sample was based on a two hour watch period starting between 1100 h and 1300 h every day except for cold or wet periods. Of course there were some days missed or observation periods of less than two hours. The elevation was 50 m, and the count was by unaided eye.

The numbers of butterflies actually seen in such a count could be affected by a very large number of factors, some of which relate to actual population levels, while others may not. Examples of the latter are mowing, pruning, and planting practices on adjacent properties, which could affect the spatial distribution of host plants and nectar sources, and thus individual dispersal as well. Since the individual butterflies were not marked, the counts can at best be regarded as an

TABLE 1. *Danaus plexippus* two hour daily per week count for twelve years at an observation point in Citrus Heights, California, U.S.A.

Date	1970	1971	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
II/26–III/4	—	—	—	0	0	0	—	0	0	0	0	0
III/5–11	—	0	0	0	0	0	—	0	1	0	0	0
III/12–18	—	0	0	1	0	1	—	0	0	0	0	0
III/19–25	4	0	0	0	0	0	3	1	3	0	0	0
III/26–IV/1	2	3	0	0	1	0	1	0	2	0	0	0
IV/2–8	5	2	0	3	0	1	2	0	3	0	5	0
IV/9–15	1	1	0	0	1	4	5	2	3	0	4	0
IV/16–22	0	0	0	0	0	2	7	0	0	0	1	2
IV/23–29	0	0	1	0	0	1	4	2	0	1	3	0
IV/30–V/6	1	0	1	1	1	1	1	2	0	1	0	1
V/7–13	1	0	0	0	2	2	1	0	2	0	0	0
V/14–20	0	1	0	0	0	2	1	0	0	0	0	0
V/21–27	1	0	0	0	0	0	0	1	1	0	1	0
V/28–VI/3	0	0	0	1	1	1	0	6	4	2	2	0
VI/4–10	0	2	1	1	2	0	3	2	2	3	3	0
VI/11–17	2	1	2	2	0	0	1	3	2	1	3	0
VI/18–24	3	1	0	2	0	1	1	2	1	0	3	0
VI/25–VII/1	1	0	1	1	0	0	0	3	0	0	2	1
VII/2–8	1	1	1	0	0	0	0	3	2	0	2	0
VII/9–15	2	1	0	4	0	0	1	10	2	3	5	1
VII/16–22	4	1	1	1	2	1	2	13	3	0	2	7
VII/23–29	4	10	5	3	5	1	7	14	2	1	6	4
VII/30–VIII/5	3	11	3	6	7	8	3	15	3	7	5	16
VIII/6–12	1	10	3	9	15	4	14	7	5	9	6	6
VIII/13–19	5	15	7	7	3	1	7	26	7	5	5	5
VIII/20–26	5	0	3	12	9	7	3	8	3	5	4	3
VIII/27–IX/2	16	—	1	7	2	6	2	3	4	8	4	2
IX/3–9	15	—	1	10	10	7	2	2	1	2	4	4
IX/10–16	14	—	1	3	5	2	1	5	1	9	2	3
IX/17–23	9	—	1	3	8	11	3	0	2	6	3	6
IX/24–30	4	—	0	3	16	5	1	4	4	2	4	1
X/1–7	4	—	0	1	13	11	3	3	3	3	1	1
X/8–14	1	0	0	0	4	3	0	0	0	0	1	3
X/15–21	1	0	0	0	1	0	2	4	0	0	0	3
X/22–28	0	0	0	0	0	1	0	3	0	0	0	1
X/29–XI/4	0	0	—	0	—	1	0	0	0	0	0	0
XI/5–11	0	0	—	—	0	0	0	2	0	0	0	0
XI/12–18	0	0	—	—	—	0	0	0	0	0	0	0
Total	100	60	33	81	98	79	70	147	70	71	83	68

index of local abundance and certainly not as literal population estimates. Nonetheless, they are definitely useful. Throughout the twelve years there were no major disturbances in the surrounding vegetation or land-use patterns, and the count methods, however idiosyncratic, were thoroughly consistent. The data are thus indicative of local abundance, and similar long runs of such data are rare in the butterfly literature. They are largely consistent with trends observed in the same geographic area, using more extensive sampling methods by A. M. Shapiro (pers. comm.) between 1972 and 1982.

TABLE 2. *Nymphalis antiopa* two hour daily count per week for twelve years at an observation point in Citrus Heights, California, U.S.A.

Date	1970	1971	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
I/16–21	—	—	—	—	—	—	—	1	0	1	0	0
I/22–28	—	—	—	—	—	0	—	0	0	0	0	0
I/29–II/4	—	0	—	—	—	1	—	0	0	0	1	0
II/5–11	—	0	—	—	—	0	1	0	1	3	0	0
II/12–18	—	0	—	0	—	0	0	0	0	1	0	1
II/19–25	—	0	0	1	—	0	0	0	0	0	1	0
II/26–III/4	—	0	0	0	0	4	0	0	0	0	1	1
III/5–11	—	1	0	0	0	0	2	0	5	0	6	1
III/12–18	—	1	0	0	0	0	0	0	0	0	1	0
III/19–25	0	3	0	0	1	0	0	0	2	0	0	0
III/26–IV/1	1	2	1	0	1	0	0	0	0	1	0	0
IV/2–8	1	2	1	0	1	0	3	1	4	0	1	0
IV/9–15	1	0	0	0	0	0	1	0	1	1	0	0
IV/16–22	0	0	0	0	0	0	0	1	0	0	0	0
IV/23–29	0	0	0	0	0	1	0	0	1	0	1	0
IV/30–V/6	0	0	0	0	0	0	0	0	0	0	0	0
V/7–13	0	0	0	0	0	0	0	0	1	0	1	0
V/14–20	8	0	0	0	0	4	2	2	1	3	3	0
V/21–27	39	0	4	3	0	8	1	1	11	5	19	0
V/28–VI/3	57	2	3	0	0	10	6	1	6	2	12	6
VI/4–10	24	18	4	2	4	11	5	2	8	10	3	2
VI/11–17	150	21	0	0	3	7	3	2	1	0	3	5
VI/18–24	58	5	0	1	2	4	0	1	4	0	0	0
VI/25–VII/1	15	1	0	0	4	0	0	0	1	1	1	1
VII/2–8	6	4	0	0	7	0	0	2	2	3	0	0
VII/9–15	2	5	0	0	2	1	0	5	2	1	0	0
VII/16–22	6	4	1	0	1	0	0	2	0	0	0	0
VII/23–29	6	7	1	0	4	1	0	2	0	0	2	3
VII/30–VIII/5	18	13	0	0	0	1	0	2	1	0	0	1
VIII/6–12	3	3	0	1	0	0	0	1	0	0	0	0
VIII/13–19	0	2	0	0	0	0	0	1	0	0	0	0
VIII/20–26	1	0	0	0	0	0	0	0	0	2	0	1
VIII/27–IX/2	0	0	0	0	0	0	0	0	1	0	0	1
IX/3–9	0	0	0	0	0	0	0	0	0	0	0	0
IX/10–16	0	0	0	0	0	0	0	0	0	0	0	0
IX/17–23	0	0	0	0	0	0	0	0	0	0	0	0
IX/24–30	2	0	0	0	1	0	0	0	0	0	0	0
X/1–7	0	0	0	0	0	0	0	0	0	0	0	0
X/8–14	2	0	0	0	1	0	0	0	0	3	0	1
X/15–21	0	0	0	0	2	0	2	0	3	1	0	0
X/22–28	0	0	0	0	0	0	0	1	2	0	1	0
X/29–XI/4	0	0	0	0	0	1	0	0	0	0	0	0
XI/5–11	0	0	—	0	0	0	0	0	0	0	0	0
XII/17	—	—	—	—	—	1	—	—	—	—	—	—
Total	400	94	14	8	35	56	26	28	48	38	57	24

Because of missed days and less than two hour watch, data for 1972 are not included. That is most unfortunate, because that season followed the coldest winter during the count years.

The year 1978 was unusual. Following the drought of 1976 and 1977,

TABLE 3. *Papilio rutulus* two hour daily count per week for twelve years at an observation point in Citrus Heights, California, U.S.A.

Date	1970	1971	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
III/12–18	0	0	0	0	0	0	0	0	0	0	0	0
III/19–25	4	1	0	0	0	1	0	2	0	0	0	2
III/26–IV/1	3	1	0	0	0	1	1	2	2	1	2	0
IV/2–8	16	0	1	0	0	1	3	1	2	0	9	0
IV/9–15	11	5	1	1	0	1	11	6	8	2	15	0
IV/16–22	27	0	1	1	1	10	20	3	9	8	12	13
IV/23–29	16	2	10	0	3	9	29	10	10	4	16	22
IV/30–V/6	21	0	6	11	5	13	6	14	7	17	21	35
V/7–13	10	0	6	14	10	25	4	12	6	2	16	39
V/14–20	11	5	3	8	8	20	4	7	10	8	7	17
V/21–27	33	7	2	15	5	12	0	4	10	2	10	11
V/28–VI/3	30	5	0	0	4	10	4	5	8	3	4	6
VI/4–10	4	14	0	2	2	5	4	1	5	0	1	3
VI/11–17	4	6	2	2	3	1	3	3	2	1	1	1
VI/18–24	4	2	0	0	0	0	0	9	3	1	6	1
VI/25–VII/1	15	3	5	1	0	3	4	11	8	3	22	3
VII/2–8	24	1	11	0	1	10	6	11	19	9	36	8
VII/9–15	40	2	14	12	5	22	10	47	23	25	21	21
VII/16–22	27	28	13	9	16	33	16	51	38	17	21	59
VII/23–29	50	25	30	38	30	53	27	76	48	18	35	90
VII/30–VIII/5	23	44	39	44	40	30	12	58	31	35	26	92
VIII/6–12	24	28	13	58	31	17	26	36	24	33	9	96
VIII/13–19	7	20	7	11	38	23	11	14	9	9	7	33
VIII/20–26	5	4	1	3	19	10	6	8	2	2	2	17
VIII/27–IX/2	15	3	2	0	9	5	2	6	8	3	4	3
IX/3–9	10	0	2	1	3	5	1	1	4	1	2	1
IX/10–16	1	0	0	0	2	0	0	3	1	2	0	0
IX/17–23	1	0	0	0	0	0	0	1	0	0	1	0
IX/24–30	1	0	0	1	0	1	0	0	0	0	0	0
X/24	0	0	0	0	0	0	0	0	0	0	0	1
Total	435	206	169	232	234	323	210	198	297	203	306	572

D. plexippus reached the highest count observed, and *P. rutulus* reached the fourth highest weekly count. Several other species not systematically counted were also present in the greatest numbers seen.

A scrutiny of Tables 1 through 3 will give an understanding of the variation of population of the species. It has been said that butterfly populations are declining (Moucha, 1974; Newsom-Brighton, 1982). These data do not support that statement, but perhaps twelve years' count is too short to say.

Citrus Heights is not a very good site for counting *D. plexippus* (Table 1), because there are no known *Asclepias* within miles. However, it is in the migratory path to the coastal hibernal colonies. The majority of those caught were females, many of which were fluttering over vegetation before late August. After that practically all flew straight through in a south or southwesterly direction.

The data do not show the great swings in *D. plexippus* population reported in the eastern U.S. and Canada (Urquhart, 1960), where in some years there are practically none. Locally they varied within more narrow limits, from a high count of 147 in 1978 to a low of 33 in 1973. There were few spring migrants seen here. The maximum number per week was seven in 1977 in the spring.

D. plexippus reaches a peak population in mid-August of most years. Do they start migrating at that time? It is known that they start arriving at the Richmond colony, the closest one at a distance at 130 km, in mid-September (pers. obs.).

The count of *N. antiopa* is the most fascinating of the three species. It has the greatest variation from a high of 150 in the week of 11 to 17 June 1970 to zero in 1974 and 1980. The total yearly count goes from a maximum of 400 in 1970 to a minimum of eight in 1974.

This count supports Shapiro's (Shapiro, 1974) theory that it goes into hibernation after the generation of late May and early June, because few sightings are made after that. This behavior is a great mystery because there is seemingly ample time and food for the production of another generation here in late August and September. It would seem to be a great opportunity to increase its numbers and thereby, increase survival potential.

Individual *N. antiopa* can be seen here in late fall and winter months on warm sunny days. The earliest was 19 January 1980 and the latest was 17 December 1976. It should be noted there were only four sightings from the week of 27 August to 2 September to 8 to 14 October. There were few sightings after that.

There is a problem with the count in May and June. There is a grove of *Salix babylonica* 80 m east of the observation point where most of the sightings were made. There were so many that the same individual was likely counted several times. I arbitrarily decided not to count a second appearance for two minutes after the first to reduce duplicate counts. If an individual was in view for several minutes nothing was counted for the two minutes after it disappeared.

Fortunately, I started counting *N. antiopa* in 1970 because of the unusually large population that year. From casual observation in 1968 and 1969 there were few in those years.

P. rutulus was the most numerous during the count period. However, the numbers cannot be compared interspecifically because of behavioral differences among the species (specifically, male patrolling behavior or territoriality in *P. rutulus* which would tend to increase repeat sightings and hence the count). Once again, only an intraspecific index of abundance can be inferred. *P. rutulus* reached a peak annual count in 1982 of 572, followed by another peak of 435 in 1970. The minimum annual count was 169 in 1973. It is the last to appear of the three species and the first to disappear. It never appeared before 20 March, and several years it appeared on that date. In 1975 it didn't appear till 20 April. The latest it appeared was 22 October 1982.

In 1978 following the driest winters on record of 1976 and 1977, *P. rutulus* reached the fourth highest weekly count of 76 the week of 23–29 July. In 1982 following the wettest winter this century the three consecutive weekly counts starting 23 July reached the highest of 90, 92, and 96. These facts lead to the obvious but incongruous hypothesis that *P. rutulus* thrives on extremes of rainfall. A possible explanation is that these extremes reduce predators.

Only in 1970, 1973, and 1982 did the spring count accurately predict the summer count. The springs of 1970 and 1982 were the highest of the twelve (12) years and were followed by high summer counts. The spring 1973 count was the lowest followed by the lowest summer count. The spring 1978 count was the second lowest followed by the fourth highest summer count. Therefore, generally, spring counts are unreliable predictors of summer counts.

Finally, from these data the July 4th butterfly census of the Xerces Society is conducted when few individuals of the species studied are on the wing in lowland central California at least, and therefore, potentially misleading.

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LITERATURE CITED

FIGGINS, W. E. 1971. Climate of Sacramento, California. NOAA Technical Memorandum NWS-WR-65. Salt Lake City, Utah. 63 pp.

MOUCHA, J. 1974. A Color Guide to Familiar Butterflies. Octopus Books Ltd., London. 190 pp.

NEWSOM-BRIGHTON, M. 1982. Butterflies are free. National Wildlife 20:27–34.

SHAPIRO, A. M. 1974. The butterfly fauna of the Sacramento Valley, California. J. Res. Lepid. 13:73–82, 115–122, 137–148.

——— 1979. Weather and the lability of breeding populations of the checkered white butterfly, *Pieris protodice* Boisduval and LeConte. J. Res. Lepid. 17:1–23.

URQUHART, F. A. 1960. The Monarch Butterfly. University of Toronto Press. Toronto, Canada. 361 pp.